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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS
FOREST PRODUCTS
FOREST ECONOMICS
RANGE RESEARCH

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BRANCH OF RESEARCH

December, 1933.

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ALLEGHENY FOREST EXPERIMENT STATION

General

Lumber Code

Forbes has worked with Director Behre and Assistant Regional Forester Evans on a code for both the hardwood and the softwood forest industries of the Northeast. With some help from outside foresters, these Federal men have drawn up a code of forest practice which they believe to be entirely practical and likely to be effective. Unfortunately, the code authority itself, which in this instance is the Northeastern Lumber Manufacturers Association, has been unwilling to admit very much of a specific nature in the code, ostensibly preferring to leave all details to the local boards of forest practice. Properly administered, we believe that the code originally proposed would have interfered comparatively little with existing industries having any considerable investment; rather, it would prevent the entry into a rising lumber market of new or newly-conditioned portable sawmills, and the entry into, or return to, mine prop operations of individuals who could not operate except through destructive methods of cutting. The mine prop operators of the State were particularly aroused over the diameter limit contained in our original code of woods practice, but it seems to us that nowhere in our territory is there greater need for a restriction on cutting, in order that the growing stock may be built up and that seedling reproduction may be fostered. Continued coppicing of the hardwood forests of the anthracite and bituminous coal regions, coupled with existing heavy fire losses, is certain to reduce the forests to a very hopeless condition. Unquestionably the proposed code would appreciably curtail the cutting of mine props in Pennsylvania, at least in the anthracite field; but inasmuch as a considerable percentage of the mine props used in that field come from outside of the State of Pennsylvania now, no great hardship should result. So far as the important pulpwood industry is concerned, the availability of both Canadian and European wood makes the present an extremely favorable time to cut down on domestic production. Another possible result of the application of the code is a considerable increase in the value of timber now standing in farm woodlots, practically unsalable.

In our effort to promote the purchase by the Federal government of a portion of the virgin timber on Tionesta Creek, within the Allegheny National Forest, the Station has been much encouraged by the attitude of the National Forest Reservation Commission. When several members of the Pennsylvania Forestry Association appeared before the Commission to urge the purchase of a portion of this tract, they were not told that the purchase was impossible, but rather that they should have the Forest Service appraise the tract, and propose the purchase of perhaps 500 acres.

Field agents of the Dutch Elm Disease Survey have made the Station their headquarters this fall. Dr. Beattie, of the Bureau of Plant Industry, in charge of the survey, stated at a botany seminar of the University of Pennsylvania that he felt there is at least an even chance of eradicating the disease in America. The total number of elms found to harbor the disease in the United States has been less than 1,000, and these have been concentrated at half a dozen ports of entry, on the Atlantic and Gulf coasts,

(Over)

and on a strip not over one or two miles wide along the railroads over which imported elm logs were carried to the veneer plants in the Middle West. One or two miles seems to be about the limit on the distance which the Scolytid beetles, carriers of the disease, ordinarily fly upon emergence from the logs. Scouting for infested trees, which had previously been felt to be impossible in winter, is proceeding vigorously in northern New Jersey and along certain railroads leading to the West.

Management

Allegheny hardwoods. A second series of 8 half-acre plots was laid out in the Kane Experimental Forest in a 40-year old stand with fewer "hold-overs" from the original growth than that selected for improvement cutting earlier in the summer. The marking based on silvicultural considerations alone resulted in a cut averaging 10 cords in this instance also, so that more than one degree of thinning proved to be unnecessary. Ten cords per acre had previously been accepted as the minimum for a commercial operation. On the earlier series of plots stem maps were prepared, in lieu of the painted numbers used on the later series. Cutting was accomplished through nearby residents, including the congregation of a local church, who were glad to obtain fuel free. Realizing that reproduction was likely to follow the heavy cutting in the first series of plots, laid out in September, Hough established a few reproduction quadrats. After Hough's departure for Philadelphia at the end of October, cultural foreman A. L. McComb of the C. C. C. worked with resident superintendent Ackerman. Some volume table measurements were made of the trees felled.

Hough reexamined the reproduction quadrats on the Little Arnot plots, and tagged a few additional trees. He discovered that someone had cut a bee tree on the check plot. Office records on the first three measurements of these plots have been brought up to date with C. W. A. help.

Hough completed his manuscript on the Tionesta virgin forest, for submission to Ecology. He has started to analyze possible relationships between soil types and stand density and composition in this tract; if the undisturbed virgin forest bears no appreciable relationship to the soil types recognized by the soil survey, it would seem impossible to expect any correlations between second growth and the same soil types. The soil survey men themselves were unable to discern any relationship.

Forbes prepared a popular article on the tract, using it as an illustration of the value of virgin timber areas for scientific study. It has been extremely gratifying to us to find that the Pennsylvania Forestry Association continues to regard the scientific value in this tract of paramount importance.

Coastal Plain

Lack of field assistance has handicapped Wood very severely in his excavation of root systems of chestnut oak saplings. He was able to get out only about 10 percent of the roots of the sapling converted into a sprout last spring, for comparison with the normal sapling excavated in 1932.

A 10-percent examination might have been satisfactory, if it had been possible to distribute this percentage over the entire root system; as it was, mechanical difficulties necessitated taking out the surface roots first.

Wood has been washing out seedlings of chestnut oak from beds planted in the last two or three years, including those in which the pH had been altered by the application of lime, those which had received applications of potash, and those from which all competing vegetation had been removed by spading. The root systems of seedlings in the spaded beds are conspicuously better than in the check beds. After attaining rather uniform success in influencing pH through surface applications of ground limestone, Wood has been puzzled by the very irregular results obtained from liming in a much more thoroughgoing manner, namely the mechanical mixture of the lime with several layers of the soil. He sowed three beds of chestnut oak acorns this fall; we cannot depend on natural reproduction to supply us with seedlings for study.

Mensuration

Schnur completed the outline of his oak yield manuscript, and started work on the actual text. He has reviewed rather thoroughly all current manuscripts on similar topics, and has compiled some data from the Census and other convenient sources on the economics of oak.

Before being kept from the office by a severe illness and operation, Miss Loose prepared two loblolly pine volume tables, one in merchantable cubic feet, the other in board feet by the International Rule. Schumacher's logarithmic method was used in preparing these tables. Owing to the extreme pressure of other work, Schnur was unable to participate in the field establishment of some loblolly pine thinning plots on the Eastern Shore of Maryland. The plots are to be established with C. C. C. labor on one of the state forests, and it is a great pity that we could go no further than to advise with the Maryland authorities by mail. In recommending different degrees of thinning, Schnur used total number of trees per acre as the criterion, rather than standards based on crown classification. The layman is much more likely to be able to pick out and reserve from cutting the thriftiest tree in every block of given dimension, than to select for further growth the most promising dominants in a stand, which may or may not be well distributed.

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APPALACHIAN FOREST EXPERIMENT STATION

Management, North Georgia

Barrett reports that computations of a permanent growth strip established in the early spring of 1931 on the woodland of the Georgia Mountain Experiment Station and remeasured following the growing season of 1933, show an annual increment of about one-third cord per acre over the three year period.

Management, Coastal Plain

Computations on a study of some factors affecting the storage of loblolly pine seed were completed. This work showed:

1. The viability of seeds stored in a commercial ice house did not decrease with length of storage period up to 84 days. Storage in a spring house or greenhouse did result in a decrease in viability with increase in the length of storage period up to 84 days.

2. The kinds of media, sand, peat, or longleaf pine litter, had no appreciable effect on viability of seed or on the length of time required for seeds to germinate after storage.

3. Moisture content of storage media had an appreciable effect on both viability and length of time required for germination. Storage in moist media apparently occasioned loss in viability and resulted in faster germination after storage for all periods up to 84 days in a commercial ice house, spring house, or greenhouse, except that seeds stored 84 days in moist media in the greenhouse germinated before they were removed from storage.

Generally speaking seed stored in moist sand or peat in a commercial ice house germinated faster with less loss in viability than seeds stored in other media or other places.

The data were analyzed using modifications of the "analysis of variance", a relatively new method never before used in the analysis of forest tree seed germination work. The results will be prepared for publication in the near future.

News has just been received that the Windsor, N. C., selective logging permanent sample plots, established in 1929, have been recently burned over by an accidental fire. This is the last of three groups of plots on private lands in the Atlantic Coastal Plain to be burned over by accidental fires.

Streamflow and Erosion

Among the other activities carried out under the erosion and streamflow project during the month has been an attempt to visit and study some of the erosion control works that were established prior to 1900 in Western North Carolina. A number of instances of successful rehabilitation of gullied and eroded old fields are available illustrating the works of Dr. Schenck and his pupils on the Biltmore Estate prior to the establishment of the national forest. As some of these activities were carried out on land that is now within Pisgah National Forest, opportunity is present to carry out as detailed a study on these early erosion control works as desired. In addition an area of old field within the Pisgah National Forest, lying adjacent to the Bent Creek Experimental Forest has been selected for experimental study of surface streamflow. This area consists of four small drainages of approximately five to ten acres each. In two of these, adequate gully dam construction was carried out about 1895.

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Black Locust Seed.

Kellogg made arrangements with the Agronomy Department of the University to thresh the 6 or 7 bushels of locust pods collected west of Hillsboro, Ohio, earlier in the fall. The experimental separator on the farm was used for this purpose. Because of the large size of the seed, a portion of it was broken in threshing. The amount of seed secured is given below:

Tree No.	Gross Dry Wt. of Pods and sack Lbs.	Approximate Measure Bu.	Gross Dry Wt. of Pods after Threshing Lbs.	Net Wt. of Clean Seed Lbs.
1	18 1/2	2 1/2	15.6	3.5
2	16 1/2	2 1/2	-	3.4
3	11 1/2	1 1/2	10.5	2.45

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INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Boise Basin Branch Station

A new field station and experimental forest has been established in Boise Basin near Idaho City, in the ponderosa pine region of south-central Idaho. This station is to serve as the center for studies of forest management of the ponderosa pine type and for grazing, erosion, and streamflow studies in that part of Idaho. An area of 3,353 acres of the Boise National Forest was set aside for experimental purposes, and an additional tract of 120 acres for a headquarters site. The Experimental Forest is to be organized as a complete working unit under a sustained yield plan, as well as providing a laboratory for study of the more fundamental problems of ponderosa pine management. Of the 975 acres classed as grass and brush land, portions will be devoted to intensive studies of grazing influences and erosion, and of streamflow problems.

A timber survey, timber cruise, and map of a major part of the experimental forest were made by crews of CCC men. Transit traverses were made of the main streams and ridges. The timber survey was an intensive 20 percent cruise by the line-plot system. A distinctive feature of the procedure was the tally of all trees over 10" d.b.h. by Dunning tree class as well as by the usual diameter classes. CCC men were not well-trained for this type of work but the making of all duties as mechanical as possible brought about what is believed to be a fair degree of accuracy.

New permanent sample plots located in a timber sale area and totaling 72 acres, were established on the Pine Creek watershed adjacent to the experimental forest to study methods of cutting in ponderosa pine. When the plots were located, the general timber sale area was being cut under an "economic selection" plan, and two of the plots set up to furnish data on this method. Other plots were specially marked and cut according to the following schemes: (1) seed tree method, (2) strict 14" diameter limit, (3) flexible 24" diameter limit, and (4) "Forest Service" or tree class selection. A total of 5,414 "left" trees were tagged and measured and complete "utilization" measurements were made on all trees cut or destroyed.

Range Management

Spring-Fall Range

ECW and Nira activities ended at the U. S. Sheep Experiment Station at Dubois in early December. During this period there was erected a modern 4-room dwelling and a 2-car garage and warehouse to be used as headquarters for Forest Service personnel. In addition, 11,000 peeled lodgepole pine fence posts and 36 miles of woven wire are on the ground ready to start next spring the fencing of the boundaries of the U. S. Sheep Station range reserve to be used cooperatively in range research by the U. S. Bureau of Animal Industry and the Forest Service.

Despite the fact that all the labor on the above activities was done by day laborers and therefore took severe toll from the time of research overhead to oversee, range research at the Sheep Station progressed rather satisfactorily due to the able assistance of Pechanec. A new method of measuring actual utilization of grasses was developed which promises to be of great value in grazing capacity tests at the station.

Desert Shrub Project

The desert shrub project has new headquarters buildings consisting of an office-laboratory, a mess and bunkhouse, two dwellings, with garage, barn, and warehouse practically complete, and an experimental winter range almost enclosed with 51 miles of boundary fence. The above work was largely done with a CCC camp and is now being rushed to completion under a Nira program. Water has been reached in a well 509 feet deep, and it is now being developed for pumping.

Four sheep owners who have used this range for the past 30 years will graze the enclosed range under a cooperative agreement. One outfit has begun grazing and the others will do so in the next few weeks.

In addition to construction, the CCC boys under the direction of Dr. W. P. Cottam, Botany Department, University of Utah, made a complete range survey of the 87 sections of withdrawn land and 20 additional sections outside to be used later for comparisons. This was done intensively, 100 plots to the section, by a new plot method recently devised. These data are now being compiled by CWA workers in Ogden.

Soil profiles were studied in a series of soil trenches dug across edges of plant types and in different plant "islands." A vegetation transect 21 miles in length was run across the desert valley and to the top of a mountain peak over 8,000 feet high. This was also done by the new plot method. Laboratory analyses of soils are to be made during the winter.

About 150 acres were sown for experimental purposes to various forage seeds as a preliminary step in artificial revegetation.

A summarized history by dates of the establishment of the Desert Experimental range is as follows:

Summers 1931 and 1932. West Desert surveyed and three prospective sites selected.

October 1932 sites inspected by Director Forsling, and Mr. Chapline of Branch of Research, Washington, D. C.

November 1932. Rough type map prepared and report filed in Washington.

February 1, 1933. Area designated by executive order.

May 26. Cadre of Virginia boys under Lieut. J. C. Wade arrived at Milford, Utah.

June 1. Twenty-five local boys added.

June 4, Permanent camp occupied at Wah Wah Springs.

July 1. Fifty more men arrive and Capt. Sapia-Bosch put in charge.

July 15. Camp increased to 200 men.

September 4. Fifty men released.

October 26. Camp withdrawn save 30 men as spike camp.

November 20. All men withdrawn.

January 5, 1934. Experimental grazing begun.

January, 1934. Building construction will be complete.

February, 1934. Boundary fence will be completed.

Desert Shrub Winter Ranges

Records at the Intermountain Forest & Range Experiment Station during the winters of 1931-32 and 1932-33 show that on the winter and early spring ranges in western Utah and eastern Nevada sheep losses for whole communities have been from 12 to 27 percent, amounting to more than 50 percent in a number of individual outfits. These staggering losses following extreme drought and incurred in spite of heavy expenses for supplemental feeding are directly related to forage depletion on winter and spring ranges. A

careful survey of public domain ranges in Utah and Nevada recently finished, showed a decline of considerable total vegetation and a much greater one in forage value on ranges used regularly in comparison with protected or moderately used ranges, as follows:

Region	No. of Plots Studied	Decline in Total plant Cover %	Decline in Forage Value %
Eastern Utah	184	34	66
Western Utah	645	40	58
Central Nevada	544	33	58
Average		36	61

It is serious that on the average the total plant cover decreased 36 percent but still more serious that the forage value decreased 61 percent.

The greater decline in forage value is accounted for by the replacement of the more valuable plants by less valuable ones. As one of many examples, in Wah Wah Valley, Beaver County, Utah, young plants and seedlings of a non-palatable rabbitbrush were found everywhere on the test area but no seedlings at all of the highly palatable white sage and few mature plants less than ten to twenty years of age.

Plants collected following the extreme drought of 1931 contained only 0.12 to 0.27 percent phosphoric acid which is only one fourth to one half enough for proper nutrition of the animals.

Abnormally small forage production on depleted ranges further accentuated by drought and by low mineral content means recurring heavy sheep losses unless research finds a means to rehabilitate the ranges.

On the other hand, one part of Snake Valley, Millard County, Utah so far from water as to prohibit grazing except in winter had a relative grazing capacity of 100 as compared with one of 43 on similar range near enough to water to have been grazed in fall and spring for the past 12 or 15 years.

Three experimental enclosures of four acres each set up one year ago show increases in that time of approximately 10, 30 and 15 percent respectively.

Spring-Fall Sagebrush-Grass Ranges

Range surveys during 1932-33 largely on the public domain sagebrush-grass ranges used for spring-fall grazing in Utah, Nevada, and Idaho revealed extraordinarily heavy depletion of forage production when compared with protected or moderately used similar range. The actual figures are as follows:

Region	No. of plots studied	Decline in Total plant cover	Decline in Grasses %	Decline in Forage Value
Eastern Utah	46	24	50	64
Western Utah	134	29	68	59
Northern Nevada	339	20	71	76
Owyhee County, Idaho	129	28	81	64
Snake River Plains, Idaho	406	35	68	75
Average		27	67	68

Since the total plant cover decreased less than half as much as the forage value, it is clear that the better forage plants were the most seriously weakened or destroyed. The depletion in grass cover kept almost exact pace with the decrease in forage value and when correlated by areas accounts for 73 to 87 percent of the total forage depletion.

In other words, by far the larger part of the forage value on a sagebrush-grass range is in the grass, and unrestricted grazing depletes the grass cover immediately and seriously.

That these ranges can be used conservatively and still maintain their forage production is shown by the rapid increase in grass on the moderately used experimental range at the U. S. Experimental Sheep Station at Dubois, Idaho. Restricted but normal spring use followed by heavy fall use has more than doubled the forage production in comparison with the adjacent similar range given continuous spring use.

The Hansen sheep pasture in northern Utah grazed conservatively for 20 or more years was found to have a relative forage production of 100 as compared with one of 16 for exactly similar uncontrolled range immediately adjacent. During the last 10 or more years the annual forage removed from the Hansen pasture has been more than double that from the outside open range.

Research is greatly needed to find a means of restoring and maintaining these badly depleted spring-fall sagebrush-grass ranges. A heavy decline in the livestock industry is certain unless the ranges are rehabilitated. For example, in Owyhee County, Idaho, livestock have decreased from 46,000 cattle and 185,000 sheep in 1920 to 25,000 cattle and 139,000 sheep in 1930, and is still declining, due largely to poor condition of the ranges.

Management of Summer Range - G.B.B.S.

Owing to the drastic cut in regular research appropriations necessitating the discharge of the two regular field assistants in July, field work on the summer range was greatly limited. However, by a very fortunate selection, two enrolled CCC boys, who were college graduates, were obtained to carry forward the routine work. By a special effort put forth in early spring, while the two regular field assistants were available, and by the

aid of Dr. E. C. McCarty, who was carried on ECF to work on the Plant Nutrition project, together with Deming who took over the field work of the erosion and streamflow project, recurrent field examinations on all projects were made.

Plant Nutrition Project

Root samples of many-flowered brome (Bromus polyanthus) were obtained monthly from January to April. From April 15 to December 1 the samples were taken at 10-day intervals, including samples not only of many-flowered brome, but also of slender wheatgrass (Agropyron tenerum) and of wild geranium (Geranium viscosissimum). When these samplesare analyzed chemically for the presence of plant foods (starch, sucrose, reducing sugars and hemi-cellulose) the results will afford added knowledge of the annual march of plant foods stored in roots and will help materially toward correlating the results of clipping studies, now being carried on, as well as the results of grazing practices.

In gathering the winter collections of root samples it was noted that green shoots appeared in many-flowered brome as early as April 18 under a 34" snow cover. The soil was loose and pliable and appeared free from frost. The chemical analysis of the root samples taken on the same dates, shows that the food storage in the roots declined markedly. As a whole, analysis of the winter collected roots indicate that the food storage in the roots decline gradually throughout the winter months, probably due to respiration, but when growth starts, as noted on April 18, the food level drops rapidly. This is probably caused by the use of the reserve supply for growth processes.

Winter collections are being continued throughout the present winter as a check.

ECW Activities

Dr. McCarty, together with selected CCC boys, carried on the Plant Nutrition project, while other boys helped to carry on routine work on standing projects.

A 25-man CCC spike camp was also detailed to the G.B.B.S. and completed 2-1/2 miles of transmission line, one dwelling, one combined mess house-dormitory, one outbuilding, and made needed repairs to the station water system. This construction will make possible the equipping of the laboratory with electric apparatus needed in chemical analyses, and will make possible more satisfactory living quarters and storage facilities.

Great Basin Erosion

The records of surficial run-off and erosion from the two erosion study areas, A and B, were continued for the past season, which completed the 19th year for this experiment. Run-off from melting snow began on May 19 and continued until July 15, this period for 1933 being from a week to ten days later than average. Weather conditions, however, favored rapid melting after May 19 and resulted in a "catching up" in time to the normal

years and produced more water than normal for the farms below. As summer rainstorms were infrequent and of comparatively moderate intensity, very little surface run-off was produced on either the grazed or the ungrazed area.

A thorough search was made for a suitable location for the installation of small surface run-off plots (1/40 to 1/10-acre in size) on which to study the influence of various degrees of intensity of grazing on surface run-off. Suitable sites were narrowed down to a choice of two locations. The final decisions as to exact location and type of installation have not as yet been definitely made.

Field examinations of watersheds on which floods originated and of flooded areas which resulted from summer rainstorms were made in Ephraim Creek, Six-Mile and Hughes Canyon drainages, all on the Manti Forest, and in the Chalk Creek drainage on the Fishlake Forest. These observations corroborated previous findings that depleted plant cover is a weighty factor in permitting flood waters to accumulate.

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LAKE STATES FOREST EXPERIMENT STATION

Civil Works

At last one emergency program has come along which is of real value to Research. A certain amount of stand improvement and fire hazard removal work has been accomplished by the CCC workers. NIRA has helped us build up our physical plants at branch stations and when RESNIRA finally arrives it is hoped that our waning appropriation for research may be strengthened. But CWP literally saves our life so far as office work is concerned.

The Station has 39 CWP workers in the office. Among them are: 1 physical chemist, 2 draftsmen, 2 statisticians, 1 librarian, and 33 clerks who have had experience and training of various degrees. With this large body of workers we are making great inroads into our accumulation of office work. Sample plot records are being compiled and brought up to date, planting records and studies of survival are being analyzed, a number of drafting jobs which have been hanging fire for some time are under way, our large pamphlet library, which was never cataloged, is now being put in shape by a trained librarian, the forest survey is assembling land records, and climatological records are being compiled for use on the fire weather study. If the project continues sufficiently long, fire statistics for Minnesota and Michigan will be brought up to date.

Besides our office project, which is perhaps the most valuable from a research point of view, we have authorization for upwards of 200 workers at branch stations in Minnesota and about 50 in Michigan. This enables us to continue with the cleanup of the slash caused by the disastrous blowdown of 1932 on the Superior, to go forward with sanitation and release cuttings on the Chippewa, as well as a certain amount of road and trail work and hazard removal, to continue fire line work at Roscommon, and to proceed with additional cultural work at Dukes.

Forestation

Stoeckeler returned the middle of the month from a seed-collecting expedition financed by the Bureau of Plant Industry, which is cooperating with the Soil Erosion Service in the collection of tree seed for planting on the Coon Valley erosion project in Wisconsin. In this work he obtained a great deal of help from Civil Works people and made rather a good showing in quantity of seed collected. Altogether he collected upwards of two hundred bushels of acorns, about a ton of hackberry seed, besides small quantities of basswood, black locust and honey locust seed.

Rudolf returned late in November from the Huron. Besides carrying forward his regular project on source of seed, spacing, and class of planting stock, he initiated this fall with the help of one CCC foreman the survey of plantations, of which there are some 40,000 acres in the Huron National Forest. This fall one twelve year old plantation of 310 acres was covered in considerable detail in order to perfect technique. It is expected that during the coming year this work will be greatly expanded. The drought during the middle of the summer on the Huron was particularly serious. Besides taking a toll in plantations of Norway pine, even those over 10 years old, it was responsible for the death of natural jack pine seedlings in thick stands of the same age.

The Denbigh Station in North Dakota was particularly fortunate in being able to obtain the services of some 70 CCC workers late in the fall before they were transferred South for the winter. With this help some 70,000 spots were prepared for spring planting and considerable work done on fire lines.

Drought Resistance of Seedlings

Before returning from the field Shirley ran 5 series (120 plants) through his drought machine. These tests, with nursery grown seedlings, revealed that drought resistance of conifers varies greatly with time of year, previous moisture conditions, light under which grown and the amount of available nitrogen with, of course, a difference between species. Now he is changing his drought machine into a 100 per cent humidity device for testing heat tolerance of Norway and white pine at high and low humidities. These tests will be carried out with CWP help and plants grown in our greenhouse will be used.

Forest Survey

This year, with the help of NIRA funds, the Forest Survey is biting off a big section of Northern Minnesota. Strips are being run at ten mile intervals through this inaccessible country. In some cases it is necessary to back-pack for a week at a time. The crew organization, where back-packing is necessary, consists of two packers, an estimator and a compassman. A week's grub, in addition to tents and sleeping bags, are carried along. Each day the packers push ahead about two miles, make camp and prepare supper and await the arrival of the estimating crew. Once the packer got tired of his job and went home. The estimating crew finally located camp after dark. On another occasion one party was caught out in a blizzard

and spent the night without food or shelter. This seems like rather heroic work in the sub-zero weather of Northern Minnesota but it has its advantages since the country to be covered is full of lakes and swamps which are much easier to cross when frozen than during the summer. At any rate mosquitoes are reported to be absent this month. Seventeen men are now engaged in field work on this project and field work has been completed for Lake and Carlton Counties. An attempt is to be made to keep the computations more or less abreast of the field work and a branch office has been set up in the Federal Building in Duluth. At present, we have eight Civil Works people on the staff engaged in drafting, computing and the assembling of records.

Measurements

Gevorkiantz returned just prior to Christmas after spending a few weeks in Northern Minnesota collecting cordwood converting factor measurements in the spruce and balsam type. He reported an official temperature reading of 54° below zero at Allen Junction, Minnesota. George says that he worked outdoors in "perfect comfort" at 29° below zero. He didn't say what he did the day it was 54° below.

Impnira

Before winter weather actually set in, Bates completed a masonry erosion dam and now, with the help of Scholz, is engaged in pouring concrete for a set of lysimeters at the La Crosse Station. Rather elaborate precautions have been taken to carry on this work during cold weather. In addition to this work, NIRA funds have made it possible to improve greatly the physical plant at the erosion station. We have already constructed a good sized machine shed, have established fire lines around the wood lot, and expect to cooperate with the Bureau of Chemistry and Soils in the reconstruction of the barn at the station.

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NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Silviculture

December was devoted to computation work on a large scale with three men on yield and thinning plot data and three men on data from the Station's numerous reproduction quadrats. Supervision of this work and occupation with various other jobs connected with it, such as outlining the methods of compiling the great mass of resulting material on atlas size summary sheets and the preparation of instructions for three new card punching and machine sorting operations, took a considerable share of Weidman's and Haig's time. Individual jobs of the month were the further preparation by Haig of his seedling survival material for publication and the start by Weidman of the assembling of data and the outlining of a western white pine manuscript to be prepared jointly by these two men.

A late fall examination of 1933 arboretum planting at the Priest River Branch reveals that some of the planting stock from nurseries in other parts of the United States, where the growing season is much in advance of that of northern Idaho, has to be held for various periods up to 34 days before parts of the arboretum ground were ready for planting. This was done by heeling-in under snow three feet deep. This storage seems to have had little adverse effect in later field survival except in the case of stock marked (°), below, which had apparently dried out somewhat in transit or had started to bud. Following are survival results of heeled-in stock:

Species	Nursery	Days Heeled-in	Fall Survival %
Pseudotsuga taxifolia	Carson, Wash.	34	45
Pseudotsuga taxifolia	Monument, Colo.	28	85
Juniperus virginiana	Halsey, Neb.	33	77
Pinus austriaca	Halsey, Neb.	28	25°
Pinux flexilis	Monument, Colo.	29	80
Picea pungeus	Monument, Colo.	25	66
Picea rubra	Parsons, W. Va.	25	20
Pinus lambertiana	Quincy, Calif.	21	70
Picea Engelmanni	Haugan, Mont.	6	43
Pinus sylvestris	Haugan, Mont.	4	43

Another interesting planting experiment of last spring from which survival results are now available is one in which different degrees of scalping were done on sod-bound ground. The Station has 25 or 30 acres of heavily-sodded, old cut-over land on which repeated plantings by conventional methods have failed in the past. Six degrees of scalping in six parallel rows with 100 ponderosa pine trees each were tried with the following results in first season survival; No scalping, 21 per cent; 12-inch square scalped, 57 per cent; 15-inch square, 64 per cent; 18-inch square, 60 per cent; 21-inch square, 77 per cent; 24-inch square, 86 per cent.

Survey

During the month twelve CWA office workers were assigned to the Forest Survey project. The men, all of them with some technical training in forestry and many with degrees from Forest Schools, are working on the timber survey data at the various forest headquarters. The works consists primarily in placing the best of the Forest's timber type data on the 2" to-the-mile overlays. These will be used in the field, where such additional information as the stocking and site will be added. The boundaries of all the burns are also being placed on the overlays so that their present conditions may be determined in the field. The men are working under the direct supervision of the Forest Officer on each Forest who is most familiar with the timber survey data. During the assignment the timber sale data data on the Forest will be all brought together, checked over, and a concrete idea obtained of the amount of work that will be necessary to complete the work inside the National Forest boundaries. Bradner or DeJarnette will inspect the work at the various forest headquarters at regular intervals during the winter.

Logging and Milling

The services of a technically trained forester were secured under the Civil Works program for computation of selective logging data. Prior to that time the only help available for assistance on the Anaconda Copper Mining selective logging study was one CCC enrolled man of clerical capacity detailed from Fort Missoula.

Anderson's time was spent in compiling logging and milling data used to support Forest Service recommendations at the various regional lumber code meetings. Lumber yield data for the Anaconda Copper Mining study was repriced using minimum code prices for ponderosa pine now in effect for the Western Pine Manufacturers' Association.

Production costs for this study did not need revision since they were already identical with wage scales and other cost items recommended under the code. Under the new set-up of code costs and lumber selling prices the minimum sized profitable ponderosa pine tree on plot 1 of the Anaconda Copper Mining Company study was 20" d.b.h. A clean cut of all trees 14" d.b.h. and up was made on this plot. On plot 3 which was cut according to Forest Service selection the minimum sized profitable ponderosa pine tree was 18" d.b.h. On plot 2 where a "high-grading" or economic selection cutting was made the minimum sized profitable ponderosa pine tree was 17" d.b.h. Only one tree in this size class and one 18" tree were cut from this area. Ninety-two per cent of the entire number of trees cut from plot 2 were 19" d.b.h. and larger. Production costs used in computing the minimum sized profitable tree for the three methods of cutting contained in the study did not include standing timber tax or a margin for stumpage and profit.

The Anaconda Copper Mining Company conducts its lumber operation primarily for the production of mining stull, sawed mining plank and timbers. During normal times 27% (by volume) of their annual log production is sorted out for stull. However, no pine stull were sorted out during the study, so the tree conversion values obtained were on a straight lumber basis.

The results of the Anaconda Copper Mining study indicate that minimum lumber selling values as established under the code will not permit a profitable operation in ponderosa pine under prevailing production costs in western Montana.

Fire Research

The 160 wind gauges that were ordered last month have been received and are now being calibrated prior to distribution at lookouts, guard stations, and ranger stations. The gauges are very inexpensive but give an accurate measurement of wind velocities below 25 m.p.h.

Range

The project, Management of Short Grass Ranges, has now been carried for 18 months at Miles City. Range deterioration on the overgrazed pastures is not yet very perceptible though records have not yet been carried far enough for detailed conclusions as to the reaction of the forage plants to the three intensities of grazing.

The reactions of the 60 cows and their calves to the varying intensities are, however, unmistakably significant now that the test has continued through a five months' summer season of 1932, the winter of 1932-33 and the full summer of 1933. Over-grazing exacts a severe weight penalty on both cows and calves even though range damage is not yet very evident.

On November 13 when the three-year old cows were moved from the summer to the winter range the 40 cows from the properly grazed and undergrazed pastures averaged 978.8 pounds. The 20 cows from overgrazed ranges averaged 888.3 pounds, a difference of 90.5 pounds per cow. This is a cumulative difference during the period from July 14, 1932, when the test started, to November 13, 1933. Corresponding weights at the time cows were moved to winter range in the fall of 1932 are 955.7 and 898.5, a difference of 57.2 pounds in favor of conservative range use at that time. Deducting this 57.2 from 90.5, difference of last November, leaves only 33.3 pounds lag in the weight during the year.

This weight difference for cows is not the only penalty of excessive grazing. At weaning time in October, 37 April and May calves from the properly and under-utilized pastures averaged 321.4 pounds or 28.1 pounds heavier than the 18 calves of similar age and breeding from the overgrazed pastures. One calf died in July so that only 54 or a 90% calf crop was weaned in October. This difference in weight developed mainly during the last month the calves were with the cows and there can be little doubt that feed shortage was the chief cause. Birth weight of the calves from overgrazed range averaged 3.67 pounds lighter than the average for the other 37 calves. Whether or not this 5% difference in birth weight is entirely due to forage shortage on overgrazed range remains for further data to answer. In view of the rather close relation between birth weights and weight at maturity such a difference is a matter of considerable importance.

This birth weight difference is an indication, if not proof, that efficiency of the cows is being reduced by inadequate range forage. Records over a longer period of time will be necessary before conclusions on this point can be safely made.

Kennedy is now in Missoula for a two months assignment. Cooney, who is being paid from Civil Works allotment, is assisting with compilation of field data.

Hurtt spent December 29 and 30 at Pullman, Washington, to observe developments at the Soil Erosion Experiment Station conducted by the Bureau of Chemistry and Soils, and on the 105,000-acre erosion control project being undertaken there by the newly organized erosion section of the Department of the Interior. Mr. Rockie is Director of this new control project. Unusual precipitation, totaling 16 inches, had fallen there since September 1, 9 inches of which occurred from December 5 to 22. Damage to railroads and roads from silt and high water has been very heavy. The greatest damage, however, is on the summer fallowed wheat fields now etched with millions of gullies down to plow sole, two or three months earlier than usual. Sample plots at the Erosion Station show soil losses during this fall period of 36 tons per acre for fallowed plots besides a high per cent of the total precipitation. Losses of both soil and water were somewhat

heavier from a devegetated plot. An adjacent grass plot artificially reseeded within the last two years lost no water or soil during this unusual precipitation. Control work on the 105,000-acre project is to be entirely from the vegetation angle and grasses are to be used almost exclusively. Up to 25% of the steeper lands are to be reseeded to grasses based on the showing made by them as controls.

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

General

December has been a wet month in the Pacific Northwest, even according to the standards of the "webfoot" region. The Wind River Experimental Forest, for example, caught 43.9 inches of rain, which beats the record for any single month. Fortunately, we had no field work under way which might have been drowned out.

There has been one meeting of the experimental forest and natural area committee at which the objections of the Regional Forester to the Ochoco Divide and North Fork Nooksack areas were heard and a compromise on the boundaries satisfactory to all was decided upon. Another natural area and an experimental forest were given preliminary consideration.

Section of Silviculture

Fire Studies - Considerable progress was made in completing the fire depletion phase of the forest survey for the remaining two Oregon units. During the month all summaries except one for these units were completed. The remaining summary is now being compiled from individual fire reports loaned by the State Forester.

Douglas Fir Silviculture

In connection with Douglas fir natural reporduction studies, records have been accumulating since 1926 on 22 groups of sample plots located in different parts of the region. Through the assistance of Nira and CWA workers, the 1932 and 1933 field notes have been posted in the file records and the seedling establishment summarized to date. The summary and analysis of the vegetative developments on these areas is about half completed. In addition to the above, the 1933 records of seed tree survival and direct seeding studies have been compiled. The results of these studies form an important part of the information used in the preparation of the bulletin on the general subject of natural reproduction in the Douglas fir region.

Mensuration

With the aid of one Nira technician and three CWA office workers, a large amount of computational work in mensurational studies is being done. A full month has been spent by one man on growth predictions for the forest

survey in the Douglas fir region. So far 10 counties in Oregon and 3 counties in Washington have been practically completed. Another job being done for forest survey use is the construction of type stand tables and diameter growth charts based upon the Lewis County strip survey. Growth estimates made by the combination of these two compilations will be compared to growth estimates made by the use of yield tables in order to determine the comparative merits of the two systems.

Other mensurational work being done by CWA help is: (1) the construction of stand tables for the spruce-hemlock type; (2) coordinated age-site-diameter height curves for the Douglas fir type, spruce-hemlock type, and ponderosa pine type; (3) increment core readings for 10 and 20 years in stands of various ages and on various sites in the spruce-hemlock type; (4) stem analyses on form 558 for second growth ponderosa pine, and Sitka spruce, which will lead later to volume tables for these species for use in intensive growth studies; (5) increment tabulations by diameter and dominance class from permanent sample plot records in even-aged Douglas fir stands to be used in determination of diameter growth curves for stand tallies or selective logging studies.

Forest Insurance

Shepard's major accomplishment was the practical completion of the explanatory text for the sugar pine-ponderosa pine region phase of the insurance study (Progress Report Number Three). A CWA assistant prepared a climatic zone atlas of the Douglas fir region and assisted on several small map jobs connected with the reports. The atlas has been gotten up to serve as a sample of the sort of reference book that will be of assistance to underwriters in rating and underwriting work.

Forest Economics

Tax delinquency and public ownership maps are in course of preparation for the following counties: Coos, Douglas, Josephine, Clallam, Snohomish and Wahkiakum. Field township plats were prepared in outline forms for Clallam, Grays Harbor, King, Kitsap, Pierce, Snohomish and Skamania Counties for Washington cooperation projects.

A number of agencies have been much interested in both the results and the methods of this project. Copies of N.P.D. forms and instructions to field men have been furnished upon request to the agricultural experiment stations of Oregon, Washington and Idaho, and conferences have been held with the Oregon and Washington project leaders of the new CWA tax delinquency and farm mortgage study being started by the B.A.E.

Selective Logging in Douglas Fir

Brandstrom's bulletin "Analysis of Logging Costs and Operating Methods in the Douglas Fir Region" is in great demand and several requests are received each day for additional copies. The lumber trade journals have made special efforts to emphasize the importance of this bulletin; they have published excellent reviews and the West Coast Lumberman in its December issue had a symposium wherein leading lumbermen expressed their candid opinion of the bulletin and its findings.

Forest Survey

Early in the month 20 CWA workers were started on forest survey office work, 4 assisting in regular computations and 16 at the reproduction of generalized type maps and the making of 1-inch-to-the-mile type maps. The statistics of 27 counties are complete, and the compilation job for only 11 west side counties remains to be finished.

Copies of the new 1/4-inch-to-the-mile base maps for the east side of Region 6, which had been mailed to various individuals and agencies in the region for correction, were returned, and all the suggestions and comments were consolidated and turned over to the Regional Office of Maps and Surveys. A second inspection of the revised tracings will be necessary before they can be mailed to Washington for lithographing.

Section of Forest Products

General

Among the inquiries of the month were some regarding the advantages of taper sawing ponderosa pine, on the uses of the minor species in the region--especially for furniture and cabinet work, and on the weight of piling of specified sizes. Following inquiries from shippers and railroad traffic agents, it was decided that a fair average weight for logs shipped over common carriers in this region was 7,300 pounds per M feet, log scale. This figure is the computed green weight of a 24-inch 32-foot log, which is the average-sized log of the region.

Cooperation - War Department

The War Procurement District at San Francisco has been supplied with base maps of western Oregon and Washington showing the distribution of sawmills and independent shingle mills by capacity groups.

Forest Survey, Cutting Depletion

The report covering the cutting depletion of the forest survey has been reviewed and is now ready for the final draft.

Lodewick spent several days summarizing data showing the trends in depletion from cutting by species during the period 1920-1932. These data are to be used as a basis for predicting future depletion by cutting.

Log Prices

Some work was done in bringing together information relative to log prices in 1931 and 1932 on the basis of the products for which they were to be used.

Motor Truck Logging

The Timberman furnished about two hundred reprints of Rapraeger's paper "Motor Truck Log Hauling in Oregon and Washington". Some of these were distributed during the month, and requests for many have been received.

Pulpwood and Pulp Fiber Identification

Lodewick plans to furnish an article on the identification of the fibers of West Coast pulp species to Paper Industry. Professor E. S. Harrar of the University of Washington will cooperate as junior author. Lodewick has also agreed to accept junior authorship with Professor Harrar in a series of three articles on the identification of western pulpwoods.

Minor Products, Prices

Lodewick devoted several days to compiling prices of cascara bark, Oregon fir balsam and cedar oil from back issues of the Oil, Paint and Drug Reporter. Prices from 1920-1930 have been completed and as time is available will be brought up to date and extended back to 1914, the earliest date for which data are available in Portland.

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SOUTHERN FOREST EXPERIMENT STATION

Financial Aspects of Private Forestry

A report covering a county-wide study of Union Parish, Louisiana, was completed in December, 1933. This is one of eleven studies, located in the various pine timber types of the South. These studies have shown timber and economic conditions as generally favorable to private forestry practice and have been especially fruitful in determining the possibilities of incomes under forest management from farm woodlands. Union Parish has over 60 percent of its area in forests and about two-thirds of the forest land is in farm woodlands. Studies of individual farms show that very few farmers practice forestry. However, in an average farm woodland of the parish it was found that the well-stocked pine stands were growing over 500 board feet per acre per year and that the average annual growth for the whole farm woodland was over 200 board feet per acre. The possible income from the well-stocked stands from sale of stumpage and pulpwood was $2.47 per acre per year and from the whole woodland was $.71. The cost of taxes, fire protection and forest management per acre per year would be $.31 for the well-stocked areas and $.23 for the whole woodland. Both forest and economic conditions of the parish are quite favorable for profitable forest management.

New Public Domain

The first half of the month was spent about equally between work on two Arkansas reports (General Report, and Little River County Report) and work in connection with C.W.A.

On December 19th Craig went to Mississippi to inaugurate C.W.A. work there. He put two men to work in Sharkey County on December 20th, platting delinquency from the county records. On December 29th he went to Little Rock, Arkansas, to address a special Land-Use Conference called by the Governor. Total attendance was about 50. The conference consisted of dis-

cussions of the various integrated problems of land-use; economic, physical, legal, and sociological. Craig spoke on "Legislation Needed for the State Land-Use Policy." The only definite conclusion reached by the conference was that under existing laws the State had no real title to reverted land and hence could not develop it. A permanent committee was appointed to gather all possible data and information on the whole subject and report back to a second meeting of the Conference.

Forest Survey

During the month of December, 1933, the field crews in both the hardwoods and the naval stores regions gained a considerable amount of proficiency in the region of their work. Week by week summaries of individual crew performance indicate an increase in crew efficiency. The results of a regular system of crew checking indicate consistent accuracy with respect to the measuring and recording of trees on field tally sheets. Field checks reveal variations on such moot points as type, condition or site. These differences of opinion usually occur only where hair line distinctions cannot be drawn. In general, the checks reveal a high standard of efficiency in the conduct of the field work.

Girard spent practically the entire month in Unit 1 in Florida, gathering data for the construction of volume tables for this unit.

Schumacher spent a week with Girard and Winters gathering tree measurements with the Liljenstrom dendrometer for the purpose of checking volume tables constructed by Girard.

Survey equipment was materially increased December 19 and 20 by the addition of 10 new Ford sedan delivery trucks to be used on survey field work; six of these were delivered to Lake City; three will be assigned on the Tennessee Valley work; and one will be used in the bottom-land hardwood units.

Forest Pathology

In addition to routine work at Bogalusa, Louisiana, an examination on December 20, 1933, was made to determine the average amount of the brown-spot needle blight. The study was made on plots established by Wahlenberg to determine the effect of periodic fires on the early growth of longleaf seedlings. The beneficial influence of fire on seedling development is largely indirect and it occurs through a reduction of the sources of infection when the old needles are destroyed by fire. In the following table, the designation "4-7" and "7-4" refers to the number of seasons that have elapsed between the occurrence of fire on the areas, both of which had been densely restocked by the seed crop of 1920.

Plot designation	Season following fire	Average amount of brown-spot	Number of seedlings examined
) 7-4 burn	2d	36.8%	100
) Check	6th	47.0%	100
) 4-7 burn	2d	41.8%	75
) Check	9th	51.7%	75

Although the effect of fire on the amount of the disease was still noticeable by the end of the second growing season. The small differences are not considered significant. The examination showed that infection was serious on all areas.

Products Pathology

A test on sap stain control of pine lumber at the Great Southern mill, Bogalusa, Louisiana, was established. Two new, supposedly improved, compounds furnished by E. I. duPont de Nemours & Co. were used in addition to soda, Lignasan and Dowicide P. The past fall has been so unusually dry that it seems doubtful whether the desired amount of information will be available from recent stain control tests.

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SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

Forest Valley Branch Station

The past season has seen unusually large accomplishments in the field of Forest Research, despite a heavy construction program made possible by Nira funds. An important factor in furthering Forest Management projects was the availability of labor from C.C.C. Camps.

E. C. W. Program

A Coconino C. C. C. camp located only 4 miles from the station provided from 20 to 40 men between June 1 and November 1. An area of 254 acres in the Forest Valley Experimental Forest was covered by improvement cutting and pruning. Progress was slow because the area was private cutting logged some 45 years ago, bearing many defective old trees and limby, opengrown trees of the younger age classes. Of the trees cut in diameter classes between 4 and 12 inches, the great majority were of unmerchantable form because of porcupine damage. Very commonly these trees had developed spreading crowns and were dominating younger trees of good form. The porcupine has been under control in this area for several years and is now doing but little damage. Natural reproduction of several age classes is generally good. One portion of the area, used as a horse and cow pasture since 1912 and severely overgrazed at times, is almost completely restocked with young trees ranging in age from 4 years to 50 years.

A mistletoe control plot of 15 acres was logged, except for skidding and hauling, by C.C.C. crews. All mistletoe infected trees which could not be cleaned by pruning were felled. On two sub-plots all remaining trees were tagged and recorded, including a description of branches pruned to remove mistletoe.

Effect of Grass Competition on Reproduction of Ponderosa Pine

Two series of seven 3-meter plots in dense bunch grass (Festuca arizonica) notorious for its adverse influence on pine reproduction, were sown with pine seed in June of 1929, just preceding the summer rains. Two were left in their

natural state, one was burned, one was completely denuded by cutting the grass just beneath the ground line, and three were clipped two or three times during the growing season to heights of 2, 6 and 10 inches. One series was screened against rodents and the other left open except that it was excluded to grazing. Germination was excellent; the original number of seedlings per plot was from 100 to 300 in the rodent exclosure and about 50 per cent less where exposed to rodents. Moisture conditions during the summer and fall of 1929 were excellent, but still large numbers died on all plots. Rodents accounted for a large proportion of the losses on the open plots, but other factors were also in operation, as shown by considerable losses on the protected plots.

Large losses occurred during the first winter. Survival was highest on the denuded plots and followed in order by the 2 and 6 inch clippings. This relation held for both rodent protected and open plots, although the latter had far fewer seedlings than the former. Another experiment carried on during the same winter indicates that light during the preceding growing season was a major factor.

The first serious loss occurred during the dry June-July period of 1930. Again the denuded plots showed the lowest mortality, followed by the 2 inch clipping.

In 1933 the number of seedlings per plot within the rodent exclosure was as follows: Two natural plots 1 and 5, burned 8, clipped to 10 inches 0, 6 inches 4, 2 inches 11, denuded 71. Of seedlings 10 inches or over in height, the denuded plot contained 29, the 2 and 6 inch clippings 1 each, and the remaining plots none. On the plots outside the rodent exclosure, so many seedlings were killed by rodents that the records ceased to have any significance after 1931.

Soil moisture samples through the growing season in the rodent protected series showed that all except the denuded plot dropped below wilting point in June and early July. During the critical period the denuded plot had a margin of from 4 to 6 per cent over the grassy plots. The clipped plots, however, were practically as dry as the unclipped ones.

It may be concluded that soil moisture is an overwhelming factor in favor of the denuded plot. The 2 and 6 inch clippings, though not comparable with the denuded plot, have a substantial advantage over unclipped plots in the size and vigor of seedlings. This appears to be due to increased light rather than moisture, as indicated by another experiment.

Remeasurement of Sample Plots.

During the past field season one of the larger "extensive" plots was remeasured the fourth time and subdivided into 408 one-acre units. This division was made in order to obtain a large number of independent observations on a unit of area basis. With the field records taken in this form the data can now be readily analyzed on the basis of a large number of independent factors such as reserved volume, average size of trees left after cutting, site index, the volume or the number of new trees on each acre, degree of release and stand vigor. The use of the last two factors, of course, depends upon the development of some suitable measure by which their magnitude can be evaluated.

The value of smaller units is not entirely limited to analysis but to the collection of field notes as well. All trees are now located with reference to acre plot number; new trees that have come in subsequent to cutting are also tied into plot number, and can easily be found without much searching. The task of tagging new trees has become progressively greater and greater each period, and has finally reached the point where a change in procedure must be made or the job will get beyond reach. The 1933 measurement recorded over 4,000 trees which had attained a diameter of over 3.5 inches during the past 5 years. Here again the acre plots will be very useful in that they will allow a random selection of a few small units on which a complete record of new trees can be kept and still be representative of the area as a whole.

The adoption of one acre as the size of the plots was not made for any specific reason other than it was felt that it would be easier to combine rather than subdivide in case either were found necessary after the data had been worked over. Later on, however, when it was found necessary to run down some inconsistencies in measurements the value of a small unit was appreciated since only a relatively small area had to be searched in order to find the tree in question.

Forest Mensuration

An analysis of increment per acre on sample plots revealed that it is closely related to the volume of the reserved stand and the volume of the average tree. These two variables alone explain approximately 80 per cent of the variance of increment; the remaining 20 per cent being attributed to such factors as the degree of release, site difference, and difference in vigor of the reserved stand.

By holding constant the influence of the average size of tree left after cutting, it was found that the yield increased with an increase in reserved volume, and that this increase came at a constantly decreasing rate. Likewise, by holding the influence of reserved volume constant it was found that the rate of increment decreased as the volume of the average tree increased, and that this decrease came at a constantly decreasing rate. This naturally follows from the fact that with a given reserved volume the amount of bole or growing surface increases with a decrease in the average size of trees left after cutting. Furthermore, as the size of the average tree decreases the average age also decreases and from the nature of the curve of growth with time it follows that more growth on the average can be expected from a given volume of young trees than from the same volume of older trees.

The average mortality for a total period of five years based on 93 one-acre plots was found to be 108.7 bd. ft. per acre with a standard error of 18.4 bd. ft. This is equivalent to approximately 22 bd. ft. per annum. No significant differences in mortality were found between periods. A significant relationship was, however, found with the volume of the reserved stand and the volume of the average tree left after cutting, and increase in either variable resulting in an increase in mortality. This relationship was not, however, strong enough to definitely establish whether or not it was proportional.

Parker Creek Branch Station

Four parallel drainages characteristic of steep slopes are bordered and working. Wooden boxes lined with galvanized iron sheeting impound eroded material while water runoff is measured through tipping buckets of one-half cubic foot capacity. Two of the four plots are 35 feet wide and 286 feet long, or 10,000 square feet in area. The other two are 35 feet wide and 143 feet long, or one-half the area of the other two but the same width. Each plot has a small gully through the center, characteristic of new drainage lines originating from recent accelerated erosion which accompanied depletion of surface cover. The plots are now fenced and have not been grazed for several years.

Vegetation is savannah in character. Quercus turbinella, Garrya flavescens, Garrya wrightii, Cercocarpus sp., Nolina macrocarpa and Ceanothus gregii are the important shrubs. Grasses as Bouteloua hirsuta, Bouteloua curtipendula, Eragrostis sp., Andropogon saccharoides and half shrubs as Menodora scabra and Eriogonum wrightii form the herbaceous cover. After a period of standardization, two of the four plots will be grazed.

The value of the small lysimeter installation at Parker Creek Station and the Summit Erosion Plot has been increased by the addition of four lysimeters to the original setup of six. At each location two lysimeters with bare soil surfaces and two lysimeters with excellent grass cover will make possible a wide range in measurement of cover influence on soil erosion, surface runoff, percolation and consumptive use of vegetation.

Some germination tests have been made of seeds of native plants of the Salt River area. The seeds of shrubs showed a high viability, Menadora scabra and Simmondsia californica in particular. The seeds of annual grasses germinated much more readily than the seeds of perennial grasses. Seeds of forbes germinated from 70 per cent in some species to nothing in others. Seedlings of bear grass, Nolina macrocarpa, grown in soil resembled June grass reproduction. This probably accounts for the often repeated remark that one never sees young bear grass seedlings in the field. Unless once positively identified they never could be recognized.

Jornada Experimental Range

Estimates and height measurements made during the annual fall charting work indicate that the 1933 forage crop is above the average and this in spite of the fact that the College Ranch which adjoins the Jornada on the west, reported a very poor forage crop. Rainfall during the Jornada growing season was less than half what it was last year but heavy rains late in June gave a vigorous start to forage growth and unusually good spacing of the remainder of the precipitation helped maintain this growth. Cattle are in excellent condition and with plenty of feed, prospects are good for a successful winter and spring season as far as the welfare of the cattle are concerned but from a financial viewpoint the year has been discouraging. Mr. Christmas, the cooperator, sold 267 calves which averaged 425 for one bunch and 457 for the other, getting 4 cents for steers and 3 1/2 cents for heifers. These at present are considered good prices for the times since recently local cattlemen have been offered only 1 cent per pound for fat, dry cattle.

Moisture Conservation

In this project, a series of shallow pits are being dug at intervals of about 8 feet in the black brush type in the southwestern corner of the Range, with a view of retarding the flood waters from the Dona Ana mountains thus preventing sheet erosion and aiding in the deposition of the richer soil formerly carried away. The area resembles a shell pitted battlefield.

Stock Tanks

Four small tanks or "tanklets" have been completed in the tobosa areas in pasture 6, and 6 more sites have been selected in this pasture for future construction. Altogether a total of 48 of these water holes are planned for the entire range. These are expected to greatly improve utilization of summer forage and since careful cost records will be kept, will also provide some economic data of importance to the cattle industry.

Range Revegetation

127 pounds of grass seed (not threshed) were sent the Boyce Thompson Arboretum in Arizona, which was the result of about 6 days of E. C. W. activity.

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RESEARCH IN REGION 2

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The results of the 1933 study of reproduction in this Fremont project, which has been running continuously for almost 20 years, were compiled. In this study, the progress of natural reproduction following clear cutting, and cutting according to the selection and shelterwood principles of silvicultural treatment, in an even-aged, overmature stand of Douglas fir is compared with that obtained under an old growth, practically virgin, stand. The number of seedlings now present on each of the four plots, on the basis of one acre, is as follows:

Seedling Age Class	Uncut old growth	Character of treatment: Selection cutting	Shelterwood cutting in 1914 (Cleared in 1926)	Clear Cutting
1925 and older	148	3035	6609	985
1926	50	609	4885	535
1927 - 1930	119	436	638	218
New since 1930	144	357	55	104
Total number of seedlings	461	4437	12187	1842

Since all of the seedlings were removed from the reproduction sections when the plots were established, the above totals represent seedlings that have come in following the initial examination.

It will be seen that the results point rather conclusively to the superiority of the shelterwood method of treatment, which consisted in a heavy shelterwood cutting in 1914 followed by the removal of the residual seed trees after 12 years, over the other kinds of treatment. This situation is accentuated when the data on the growth of the older established seedlings, namely those originating in 1925 and prior to this date, are considered. The average height of these seedlings on the shelterwood plot was found to be 12.38 inches, as compared with 10.06 inches on the plot that was clear cut at the beginning of the study, 6.77 inches for the plot that was cut according to a selection pattern, and only 2.37 inches for the uncut plot. Since 1930 the increase in height for this group of seedlings has been 54.6 per cent, 44.5 per cent, 41.6 per cent and 20.9 per cent for the plots in the order in which they are above considered.

Other conclusions derived from the results obtained in the 1933 examination are: (1) the amount of germination of the very heavy 1929 crop of seeds varied directly with the number of seed trees present on the various plots, which confirms previous results; (2) during the 1930-33 drouth period the percentage of mortality in general was greatest in the 1929 age class, followed in order by the 1927-28 class, the 1926 class and the oldest class; (3) for all classes of seedlings the mortality during this period (1930-33) was least in the shelterwood plot (20.5 per cent) and greatest on the uncut, old growth, plot (62.2 per cent), the other plots approximating the shelterwood plot much more closely than the uncut plot; (4) both Douglas fir and Engelmann spruce, the two principal species represented in the reproduction, experienced their heaviest mortality under the old-growth stand, however, spruce reproduction is less affected by the competition of the residual overstory and its percentage of representation in the stand, compared with that of Douglas fir, tends to decrease in more or less direct ratio with the degree to which the mature stand is opened; (5) on all of the cut-over plots, the number of the seedlings and the rate of growth of these seedlings is greater on that portion of the area upon which the slash was piled and burned than where it was scattered. This result is of less significance in the case of the shelterwood plot than in the case of the other plots since the slash resulting from the removal of the shelterwood trees in 1926 was scattered over the entire plot.

Pe - San Isabel:

The statistical data for the Cottonwood Creek erosion profiles, which were measured in November, were compiled. The results illustrate very clearly what casual observation fails to disclose, namely, that erosion, both sheet and gully, is progressing at an accelerated rate. Three large profiles are included, one being located just above the head, another near the middle and the third near the lower end of the gully. Although no gully is involved in the upper profile, the cross-sectional area of this profile was enlarged 6.4 per cent based on its area in the fall of 1932. Enlargement of the middle profile during the year occurred at the rate of 10.0 per cent, while the profile near the mouth of the gully underwent an 18.3 per cent increase. These

data indicate that erosion becomes progressively worse from the head to the mouth of the drain. The head of the gulley has widened itself about 3 ft. in a year's time, while its upward extension into the valley grass-land type has been at the average rate of 2.3 feet during the same period.

Mr - 1, Black Hills:

Two years after the disastrous Rochford fire, only 4 ponderosa pine seedlings are present to account for the approximately 66,000 seeds that were sown on the experimental area in the fall immediately after the fire and in the following spring. Two factors, surface washing and rodents and birds, probably are responsible for the disappearance of the seed.

So far as the vegetative ground cover is concerned, there appears to have been a decrease in its areal extension, since the fall of 1932, from 40 per cent to 16 per cent density on the east slope sites and from 16 per cent to 11 per cent density on the drier south slope sites. Too much significance can not be attached to these results for the recent examination was made in late October, after practically all of the vegetation had been killed by frost. There is some erosion, but a layer of vegetative matter is gradually being deposited on the soil which will tend to check erosion, provided that excessive disturbance by cultural use in the next few years does not disturb the balance. The worst danger from natural causes is believed to be past.

It is interesting to note that the shrubs have increased their representation within the vegetative cover from 23 per cent to 37 per cent while the grasses show an increase of 9 per cent over their 2 per cent distribution in 1932. Since the grasses, however, are mostly confined to the lower edges of the slopes, they do not constitute as important a stabilizing element as do the other kinds of vegetation. Berberis (Oregon grape), apocynum, erigeron and solidago have superseded geranium in abundance, the latter plant having been almost entirely crowded out following its early and almost complete occupancy of the burned-over ground.

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